

# How Poor Air Quality Affects Children's Health

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**California Department of Health Services**

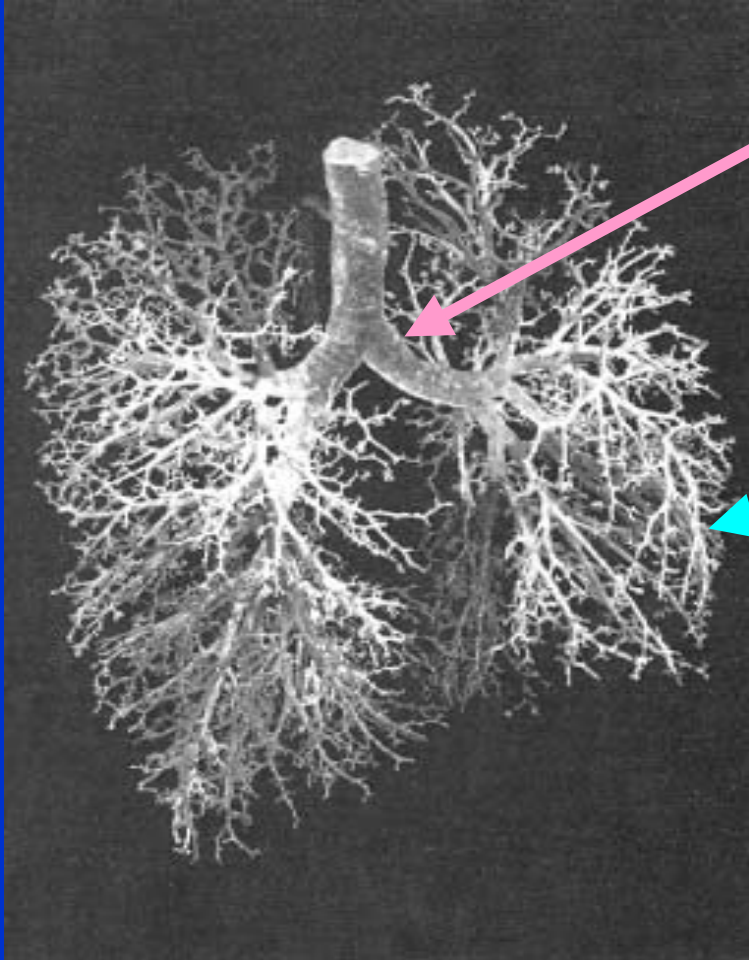
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# Common Air Pollutants and Asthma

- People with asthma considered to be sensitive to four :
  - Ozone
  - Particulate matter (PM)
  - Sulfur dioxide
  - Nitrogen dioxide
- Ozone and PM present most serious risk

# Human Lung



- Air conducting
  - Trachea
  - Bronchi
  - Bronchioles
- Gas exchange
  - Respiratory bronchioles
  - Alveoli

# Ozone

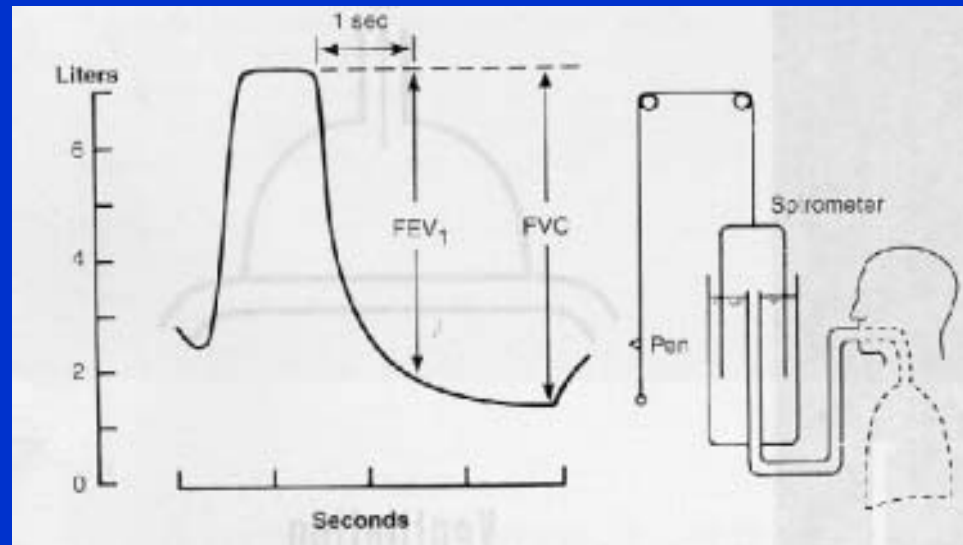
- Formed by chemical reactions involving various gases in motor vehicle exhaust and industrial emissions
- Levels tend to be lower in morning and peak in afternoon
- Major component of urban smog
- Powerful respiratory irritant that causes early and late effects
- Exposure for 1 or more hours with exercise can cause respiratory symptoms, reduced lung function, and lung inflammation

# Ozone Irritates Airways

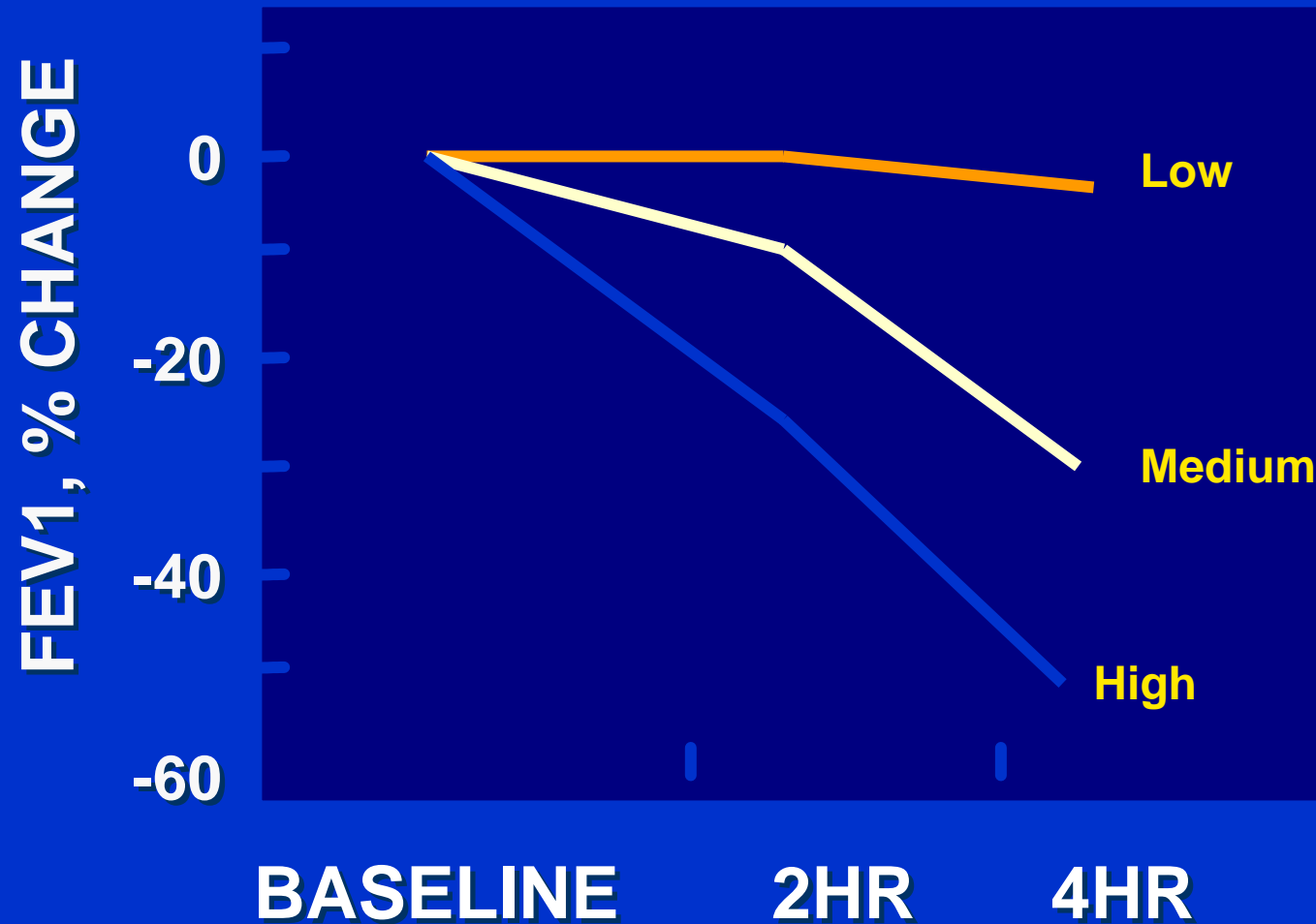
- Acute Symptoms
  - Cough
  - Sore or scratchy throat
  - Pain with deep breath, or chest pain
  - Fatigue
- Rapid onset
- Similar symptoms - people with and without asthma

# Ozone Reduces Lung Function

- Forced Expiratory Volume ( $FEV_1$ ) - volume of gas exhaled in one second
- Forced Vital Capacity (FVC) - total volume of gas exhaled



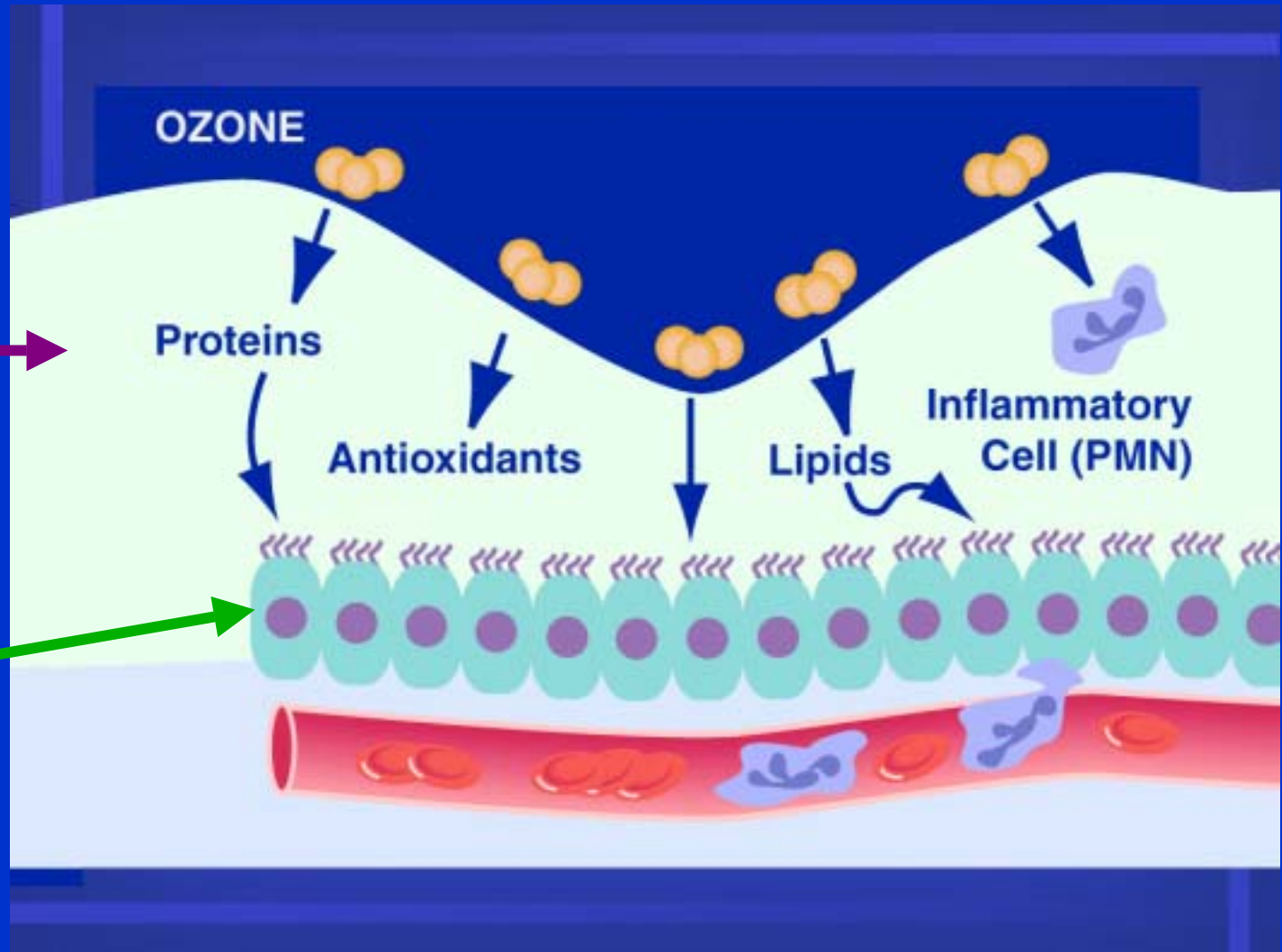
# Variability of Ozone Response



# Ozone Causes Inflammation

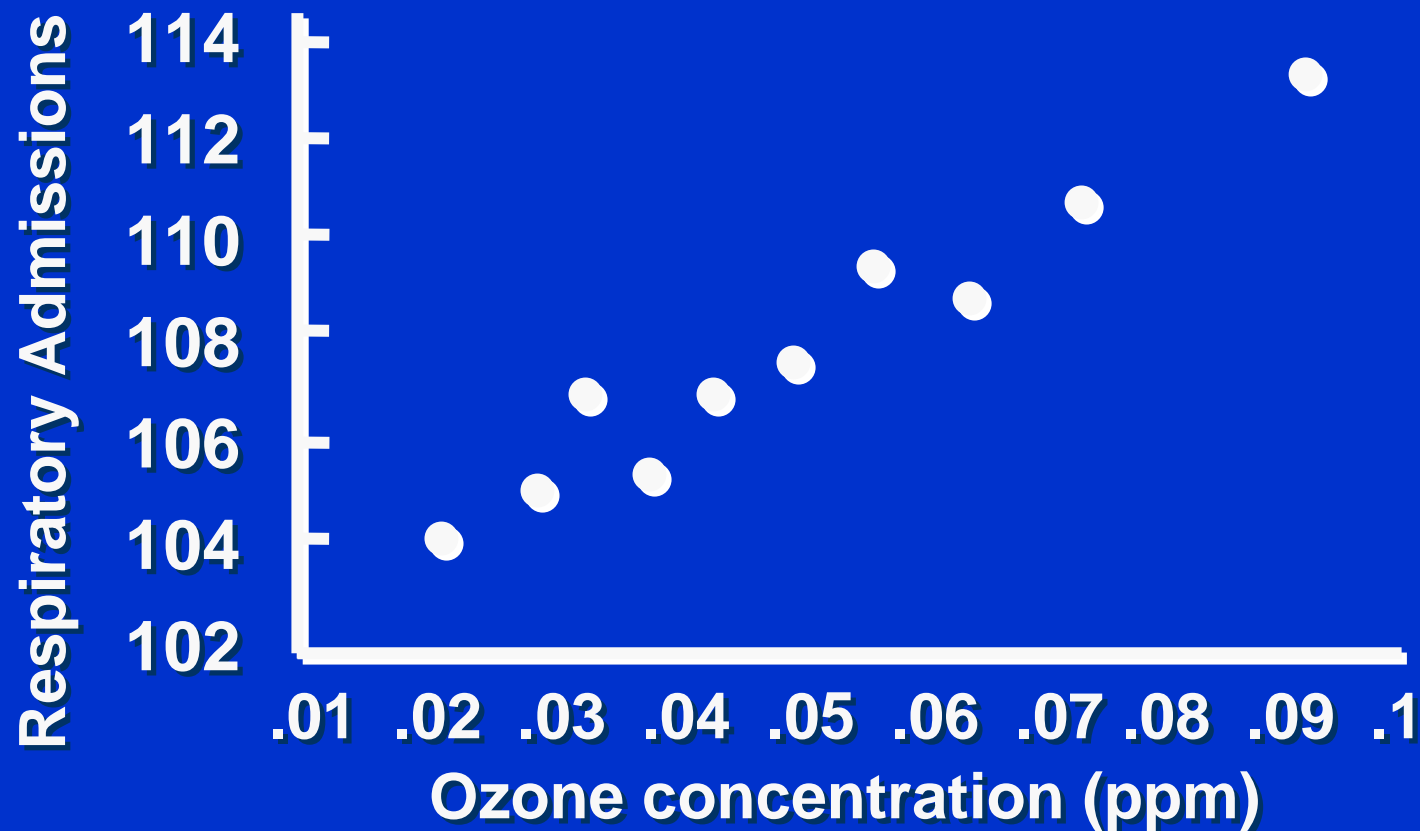
Epithelial  
Lining  
Fluid

Lung  
Epithelium





# Respiratory Hospital Admissions by Daily Maximum Ozone Level, Lagged One Day (Burnett et al, 1994)



# Respiratory Health Effects of Ground-level Ozone Exposure

- Aggravated asthma
- Reduced lung capacity and lung function
- Increased susceptibility to respiratory illnesses
- Increased school absences
- Increased respiratory hospitalizations.
- Possibly new cases of asthma

# Exposure risk in children

- Narrower airways
- Lungs are still developing and are more susceptible to damage.
- 50% more time outdoors
- More time engaged in vigorous activity (especially in the summertime when ozone levels are the highest)
- Higher breathing rate relative to body weight and lung surface area.
- Results in greater dose of pollution delivered to their lungs

# **Exercise Induced Asthma (EIA)**

## **Exercise Induced Bronchospasm (EIB)**

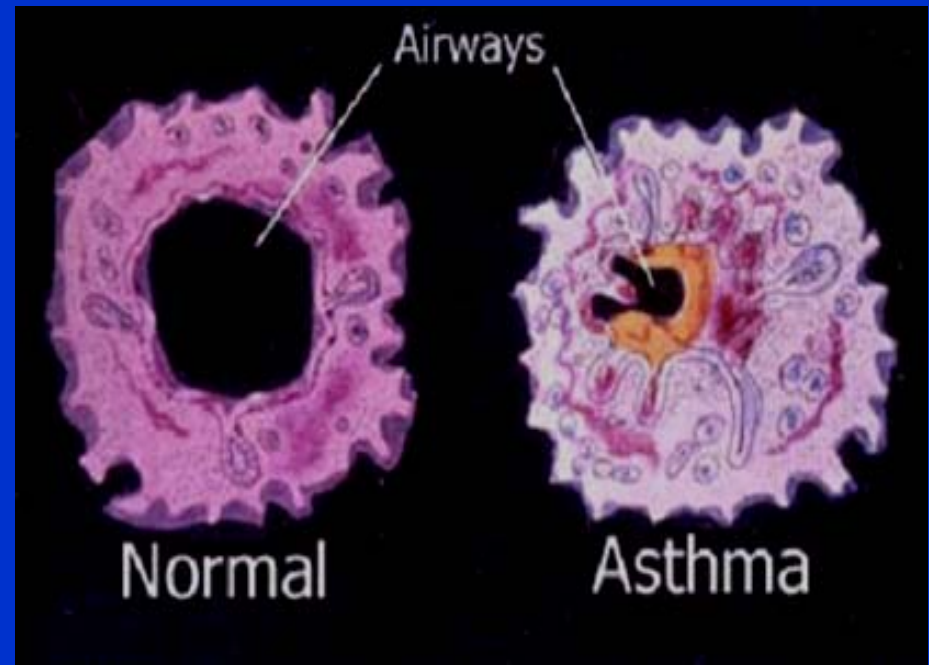
- EIB is a very common symptom for persons with asthma.
- 80-90% percent of asthmatics have difficulty breathing with vigorous exercise.
- Children who have not been diagnosed with asthma may develop breathing problems with vigorous exercise.
  - 50% of people with hay fever or allergic rhinitis (allergic runny nose)
  - 10% of normal athletes have been found to develop EIB.

# Symptoms of Exercise Induced Asthma

- **Obvious Symptoms:** wheezing, shortness of breath on exertion, chest tightness
- **Subtle Symptoms:** cough, chest congestion, chest discomfort or pain, susceptibility to cold air, tires easily, unable to run five minutes without stopping, dizziness, frequent throat clearing sounds
- **Timing:**
  - Occurs following 6-8 minutes of vigorous exercise
  - Peaks 5-10 minutes after exercise
  - Lasts 30 - 60 minutes
  - Less severe late phase may occur—symptoms begin again 12-16 hours after exercise; resolves within 24 hours

# Asthma Medications

- **Asthma Relievers**
  - Bronchodilators (albuterol)
  - Help to relieve asthma symptoms temporarily, provide quick relief as needed
- **Asthma Controllers**
  - Anti-inflammatories
  - Long-acting bronchodilators
  - Help to control asthma over time and prevent asthma symptoms or attacks



# AQI

Descriptors	Index Values	Risk Message
Good	0 – 50	No message
Moderate	51 – 100	Unusually sensitive individuals
Unhealthy for Sensitive Groups	101 – 150	Identifiable groups at risk – different groups for different pollutants
Unhealthy	151 – 200	General public at risk; groups at greater risk
Very Unhealthy	201 – 300	General public at greater risk; groups at greatest risk

# Sensitive Groups

- “unusually sensitive individuals”
  - known to be unusually susceptible to ozone
- “sensitive individuals”
  - persons with chronic lung disease or asthma
  - elderly, chronically ill
  - active adults and children



# Physical Activity

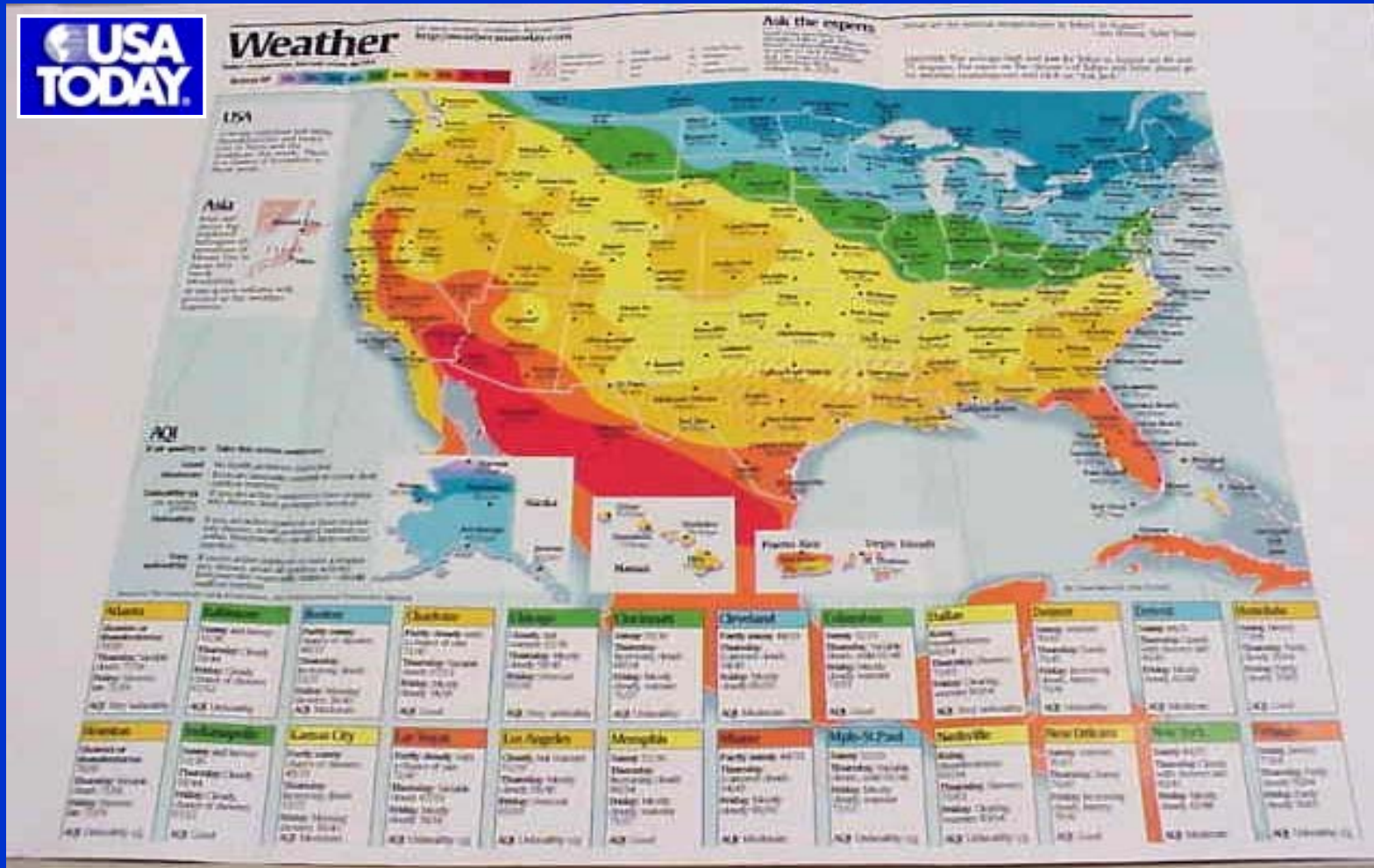
- DHS Physical Activity Guidelines
  - Elementary school children (30-60 minutes/day)
  - Adolescents (60 minutes/day)
- Moderate Exercise Activities
  - Brisk walk, climbing stairs, tennis, baseball, cycling, hiking
- Vigorous Exercise Activities
  - Basketball, soccer, running (sprints, time trials), cycling (competitive), hiking (uphill), rope skipping, swimming

# How to Reduce Risk

**Dose = Concentration x Ventilation Rate x Time**

- Reduce concentration – schedule activities when pollution levels lower
- Reduce ventilation rate by taking it easier
- Reduce time spent in vigorous outdoor activities
- Pay attention to symptoms
- Follow asthma action plan – notice changes
- Coaches – rotate players frequently
- Risk trade-offs

# Daily Air Quality Forecasts



USA Today and USAToday.com

# Daily Air Quality Forecasts

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**air quality** features

### Air Quality Forecast for the Southeast Region

Last updated May 15, 2002


City	Today Forecast Level Principal Pollutant	Tomorrow Forecast Level Principal Pollutant
Asheville Ridge Tops, NC	Good	Moderate
Asheville Valleys, NC	Good	Moderate
Atlanta, GA	Moderate	Moderate
Charlotte, NC	Moderate	Moderate
Fayetteville, NC	Good	Moderate
Ft. Lauderdale, FL	Good	-
Greensboro, NC	Good	Moderate
Hickory, NC	Good	Moderate
Hollywood, FL	Good	-
Miami, FL	Good	Good
Orlando, FL	Good	-

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**Recommended Health Links**

[Calculate the current indoor humidity for your home](#)

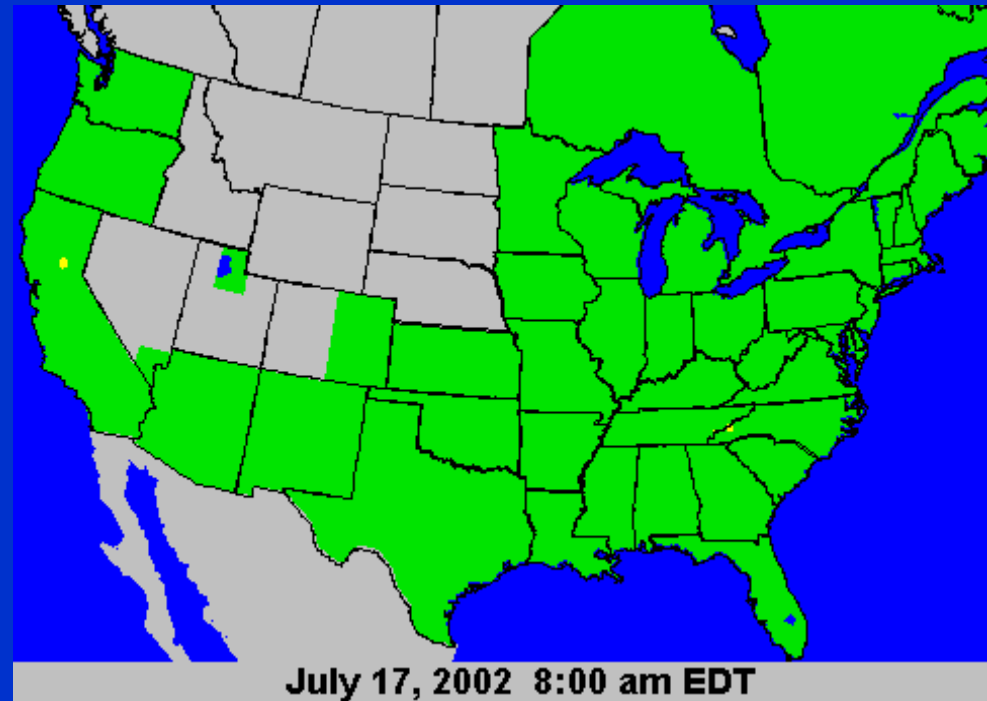
**The Weather Channel**

# Ozone Maps

## Regional



## National

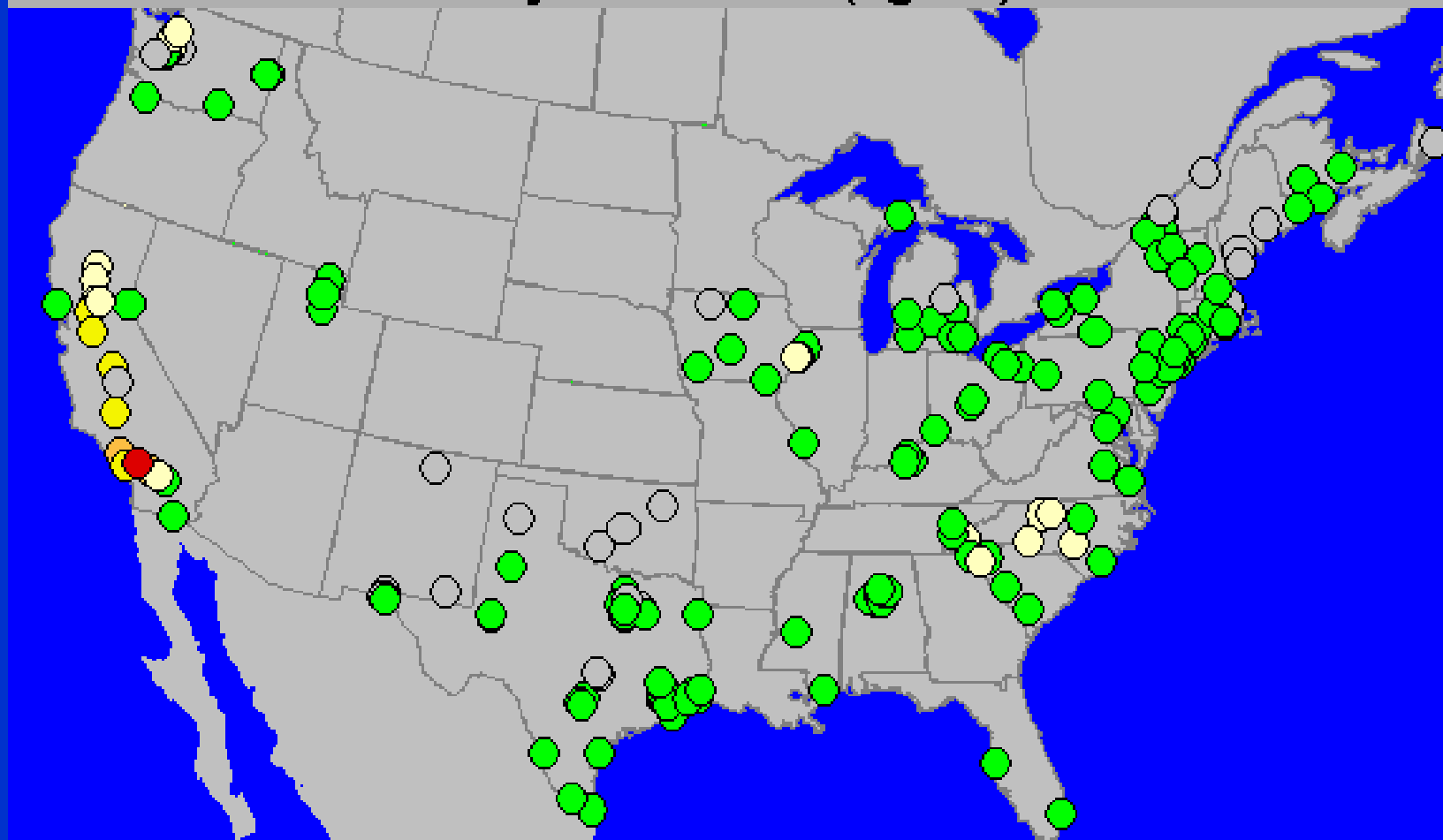


# Local Conditions



# Real-time AQI for PM<sub>2.5</sub>

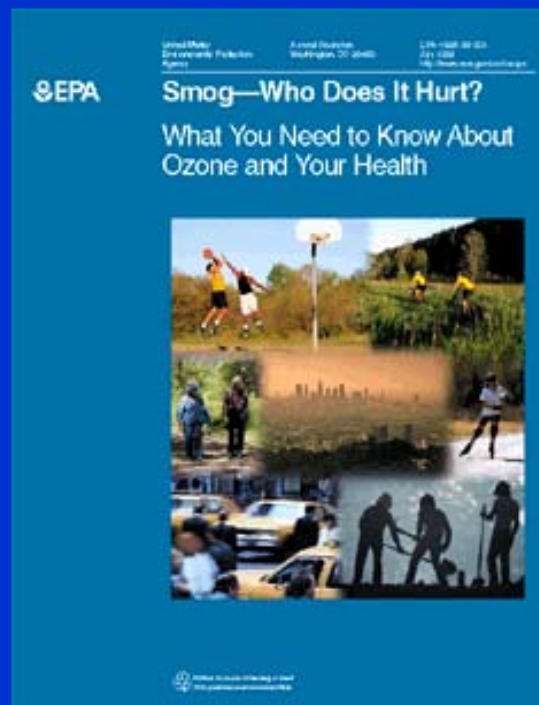
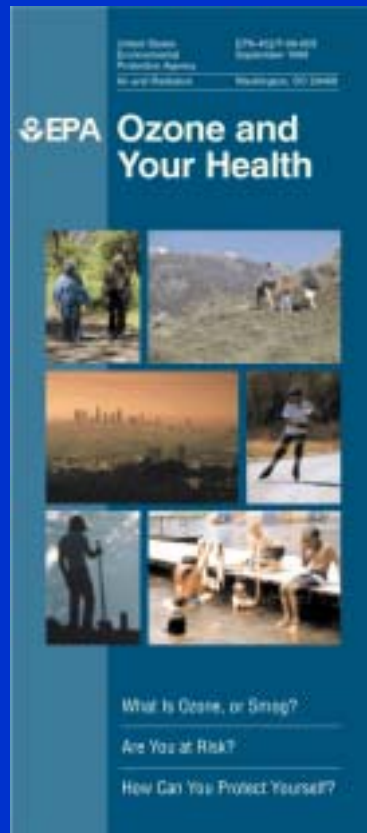
Hourly PM<sub>2.5</sub> Data (ug/m<sup>3</sup>)



October 21, 2002 12:00 am EDT



# Information Products



United States Environmental Protection Agency  
Air and Radiation  
Washington, DC 20460

EPA-404-B-00-012  
January 2000  
100 Ozone-Depleting Substances

**Air Quality Guide for Particulate Matter**

Air Quality	Air Quality Index	Protect Your Health
Good	0-50	None
Moderate	51-100	Unusually sensitive individuals should consider limiting prolonged or heavy exercise.
Unhealthy for Sensitive Groups	101-150	People with heart or lung disease, the elderly and children should limit prolonged or heavy exercise.
Unhealthy	151-200	People with heart or lung disease, the elderly and children should avoid prolonged or heavy exercise, and everyone should limit prolonged or heavy exercise.
Very Unhealthy	201-300	People with heart or lung disease, the elderly and children should avoid all outdoor activities, and everyone should avoid all outdoor activities.

For more information visit EPA's web site at:  
[www.epa.gov/airnow](http://www.epa.gov/airnow)

<http://www.epa.gov/airnow/publications.html>